McMillan
FLOW PRODUCTS

MASS FLOW METERS FOR GAS APPLICATIONS

Model 50X Series
Thermal Mass Flow Meters

APPLICATION IDEAS

Compressor or pump output monitoring

Rotameter replacement or upgrade

Verification of sample gas streams in analytical equipment

Precision gas injection and dosing

Leak testing

Product Description

McMillan Model 50X Series Mass Flow Meters are capable of measuring virtually any clean, dry gas as low as 0 – 20 sccm or as high as 0 – 500 L/min. Repeatable results are achieved using a patented thermal mass flow sensor design. This proven design minimizes zero drift while maintaining fast response and linear outputs.

Because of the compact size and affordable cost of these products, the Model 50X Series Mass Flow Meters are suitable for a wide variety of industrial, commercial, laboratory and OEM applications.

Thermal mass flow meters feature fast response, virtually zero maintenance, and precise measurement. These are essential qualities for today's variety of applications.

Principle of Operation

The McMillan Model 50X Series Mass Flow Meters utilizes thermal sensing technology. A portion of the flow entering the device is re-directed into a small tube. This tube is heated to a default constant temperature with a set of precision wound thermo-coils. As gas flows through the tube, heat is transferred from the tube and into the flowing gas, cooling the tube in the process. The thermos-coils must increase power to bring the now cooling tube back to the default constant temperature. This increase in power is measured and used to calculate mass flow. McMillan's proprietary system ensures that the zero (default constant) remains stable and the sensor is extremely repeatable.

The output of the thermal mass flow sensor is directly related to the specific heat characteristic of the gas being measured. Therefore, if a unit is calibrated for air, it is relatively simple to calculate a correction for nitrogen or other similar gases. This advantage offers flexibility not found with many other sensing technologies.
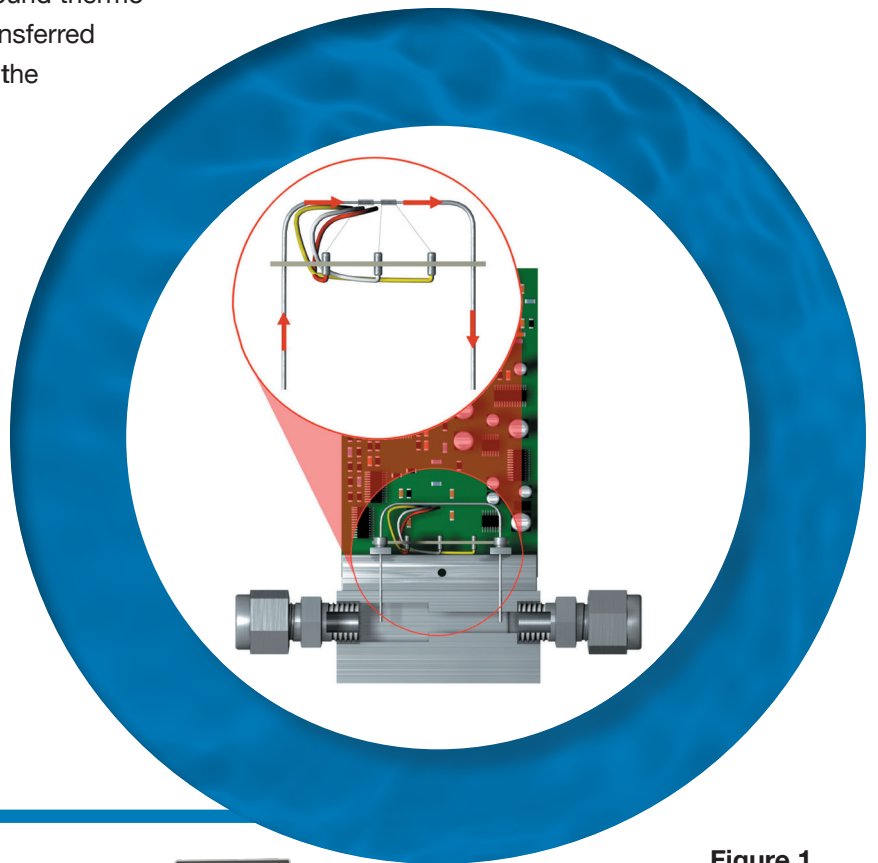

Figure 1
Cutaway of sensor technology

Features and Options

FLOW RANGES

Flow ranges from 0 – 20 sccm up to 0 – 500 L/min are available. Consult the factory or an authorized representative for custom requirements.

POWER

Units may be ordered to operate with either 12 VDC or 24 VDC power. Various power adapters are available for use with 12 VDC versions.

SIGNAL INPUTS & OUTPUTS

Choose from either 0-5 VDC or 4-20 mA linear outputs.

ACCURACY/LINEARITY

All models have a standard accuracy specification of ± 1.5% full scale accuracy (including linearity). NIST traceable calibration certificates are optional on some models.

FLUID CONNECTIONS

All units have compression-type tube fittings as standard. Consult Fitting Availability Chart found on Page 5 for available materials and sizes.

ELECTRICAL CONNECTIONS

All units have a 36" [92 cm] output cable, terminated with a 6-pin PS/2 style connector. An optional mating cable assembly, terminated with pigtail leads, is recommended to facilitate wiring.

WETTED MATERIALS

All units feature metal construction. See specifications for detailed materials in gas path. Model 50S and 50SD feature stainless steel construction; other models constructed from aluminum.

DISPLAYS*

For units with integrated displays, choose the Model 50D or 50SD. Units for ranges 2-7 will display flow in cc/min, and ranges 8-15 will display flow in L/min. Units without integrated displays may be used with McMillan's line of external remote displays.

CALIBRATION GASES*

Units may be calibrated for virtually any clean, dry gas. Several non-standard gas selections are available as indicated in Ordering Information on Page 5.


50K

50D

OPTIONAL FLOW RATE DISPLAY

03

*Contact the factory or an authorized representative for more detailed information.

Specifications

	MODEL 50K	MODEL 50D	MODEL 50S	MODEL 50SD
Accuracy (including linearity)	± 1.5% full scale*			
Repeatability	± 0.25% full scale*			
Pressure Rating	150 psig [10.3 barg]		500 psig [34.5 barg]	
Pressure Sensitivity	± 0.02% full scale* per psi [per 69 mbar]			
Temperature Rating	Operating Range: 50 to 122 °F [10 to 50 °C] Storage Range: 32 to 158 °F [0 to 70 °C]			
Temperature Sensitivity	± 0.15% full scale* or less per °C			
Body Leak Integrity (not including fittings)	1×10^{-7} sccs of He			
Wetted Materials	Aluminum 304 Stainless Steel 316 Stainless Steel		303 Stainless Steel 304 Stainless Steel 316 Stainless Steel Epoxy	
O-Ring Material	FKM		n/a	
Fitting Material	Choose from acetal, brass, or stainless steel			
Recommended Filtration	20 microns or less			
Compatible gases	Clean, dry gases compatible with wetted materials			
0-5 VDC Output Signal	Minimum 2.5 Kohm load			
4-20 mA Output Signal	Maximum 300 ohm loop resistance			
Warm-Up Time	Less than 5 minutes			
Integrated Display	none	128 x 32 pixel back-lit LCD	none	128 x 32 pixel back-lit LCD
Power Requirement	Suffix B: 22-25 VDC Suffix C: 15-25 VDC Suffix D: 12-15 VDC			
Typical Power Consumption	120 mA			
Peak Power Consumption	160 mA			
Electrical Connections	Integrated 36" [92 cm] cable, terminated with 6-pin Mini-DIN (PS/2 Style)			
Settling Time	Typically < 1 second for 97% of final value			
Reliability	100,000 Hours MTBF			

*Specifications from 10 - 100% of rated flow. Linearity is best fit straight line. All calibrations performed with air unless otherwise stated on calibration certificate.
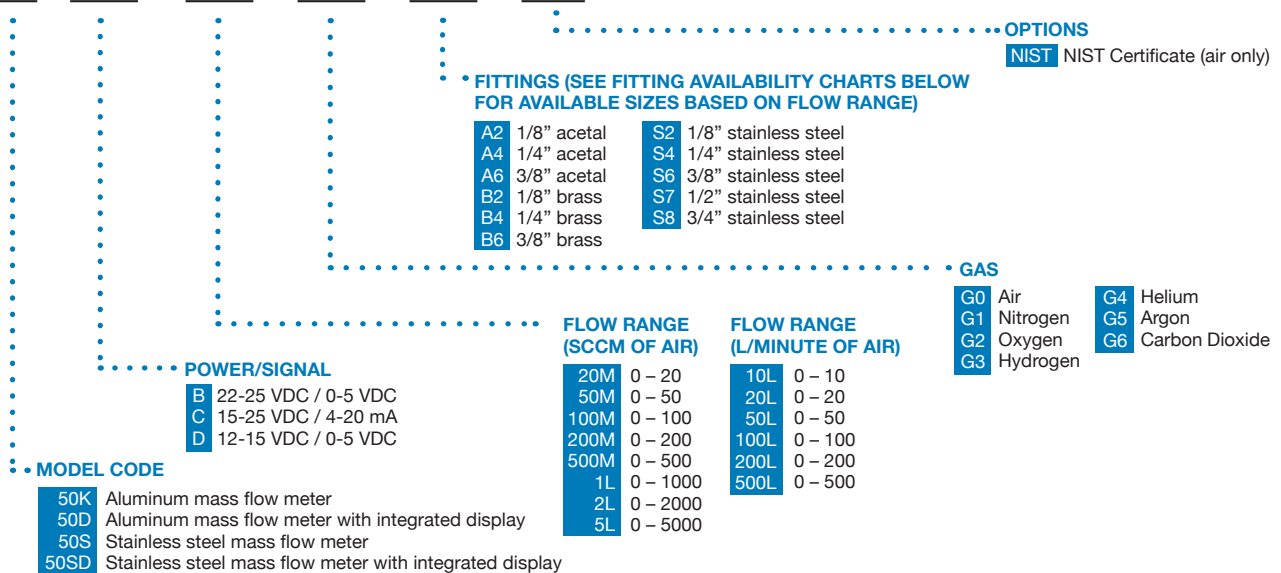
Typical Pressure Drop
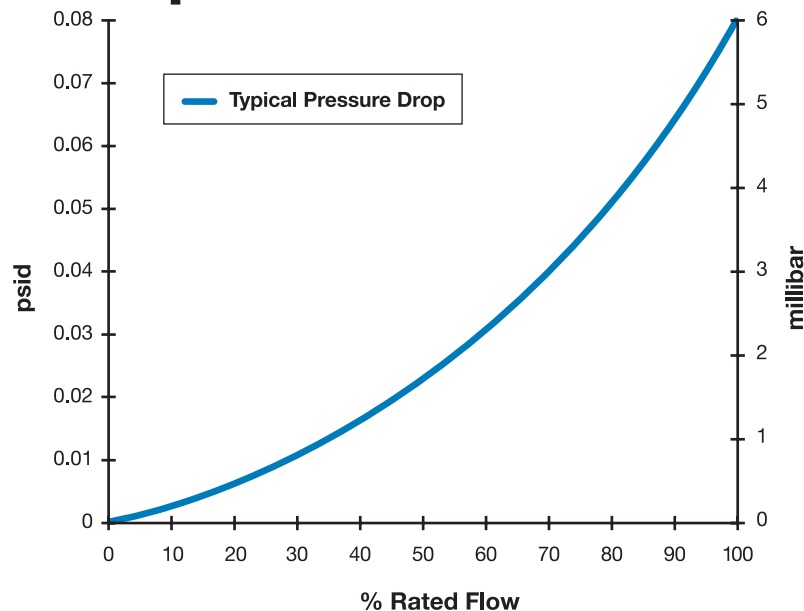
Ordering Information

Form part number as follows:

(Model Code) - (Power/Signal) - (Flow Range) - (Gas) - (Fittings) - (Options)

50 __ – ___ – ___ – ___ – ___ – ___

OPTIONS
NIST — NIST Certificate (air only)

FITTINGS (SEE FITTING AVAILABILITY CHARTS BELOW FOR AVAILABLE SIZES BASED ON FLOW RANGE)

A2	1/8" acetal	S2	1/8" stainless steel
A4	1/4" acetal	S4	1/4" stainless steel
A6	3/8" acetal	S6	3/8" stainless steel
B2	1/8" brass	S7	1/2" stainless steel
B4	1/4" brass	S8	3/4" stainless steel
B6	3/8" brass		

GAS

G0	Air	G4	Helium
G1	Nitrogen	G5	Argon
G2	Oxygen	G6	Carbon Dioxide
G3	Hydrogen		

FLOW RANGE (SCCM OF AIR)

20M	0 – 20
50M	0 – 50
100M	0 – 100
200M	0 – 200
500M	0 – 500
1L	0 – 1000
2L	0 – 2000
5L	0 – 5000

FLOW RANGE (L/MINUTE OF AIR)

10L	0 – 10
20L	0 – 20
50L	0 – 50
100L	0 – 100
200L	0 – 200
500L	0 – 500

POWER/SIGNAL

B	22-25 VDC / 0-5 VDC
C	15-25 VDC / 4-20 mA
D	12-15 VDC / 0-5 VDC

MODEL CODE

50K	Aluminum mass flow meter
50D	Aluminum mass flow meter with integrated display
50S	Stainless steel mass flow meter
50SD	Stainless steel mass flow meter with integrated display

50K	50D FITTING AVAILABILITY										
RANGE	A2	A4	A6	B2	B4	B6	S2	S4	S6	S7	S8
20M	✓	✓		✓	✓		✓	✓			
50M	✓	✓		✓	✓		✓	✓			
100M	✓	✓		✓	✓		✓	✓			
200M	✓	✓		✓	✓		✓	✓			
500M	✓	✓		✓	✓		✓	✓			
1L	✓	✓		✓	✓		✓	✓			
2L		✓	✓		✓	✓		✓	✓		
5L		✓	✓		✓	✓		✓	✓		
10L		✓	✓		✓	✓		✓	✓		
20L						✓			✓	✓	
50L									✓	✓	
100L										✓	✓
200L										✓	✓
500L										✓	✓

50S	50SD FITTING AVAILABILITY				
RANGE	S2	S4	S6	S7	S8
20M	✓	✓			
50M	✓	✓			
100M	✓	✓			
200M	✓	✓			
500M	✓	✓			
1L	✓	✓			
2L		✓	✓		
5L		✓	✓		
10L		✓	✓		
20L			✓	✓	
50L			✓	✓	
100L				✓	✓
200L					
500L					

EXAMPLES

50K-B-200M-G1-B2 would provide an aluminum-body mass flow sensor with no display, a 0-5 VDC linear output, would require 24 VDC power, have 1/8" brass tube fittings, and would be calibrated to measure 0 – 200 sccm of nitrogen.
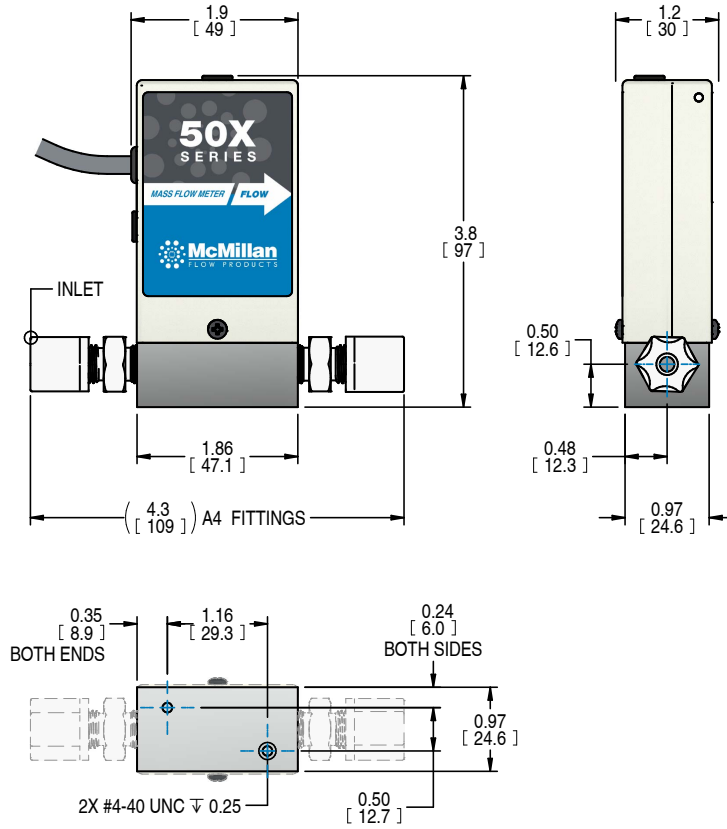
50SD-D-50L-G0-S7-NIST would provide a stainless-steel mass flow meter with integrated display, a 0-5 VDC linear output, would require 12 VDC power, have 1/2" stainless steel tube fittings, would be calibrated to measure 0 – 50 L/min of air, and would come with an NIST-traceable calibration certificate.

50D-C-20M-G6-A4 would provide an aluminum-body mass flow meter with integrated display, a 4-20 mA linear output, would provide 24 VDC power, have 1/4" plastic tube fittings, and would be calibrated to measure 0 – 20 sccm of carbon dioxide.
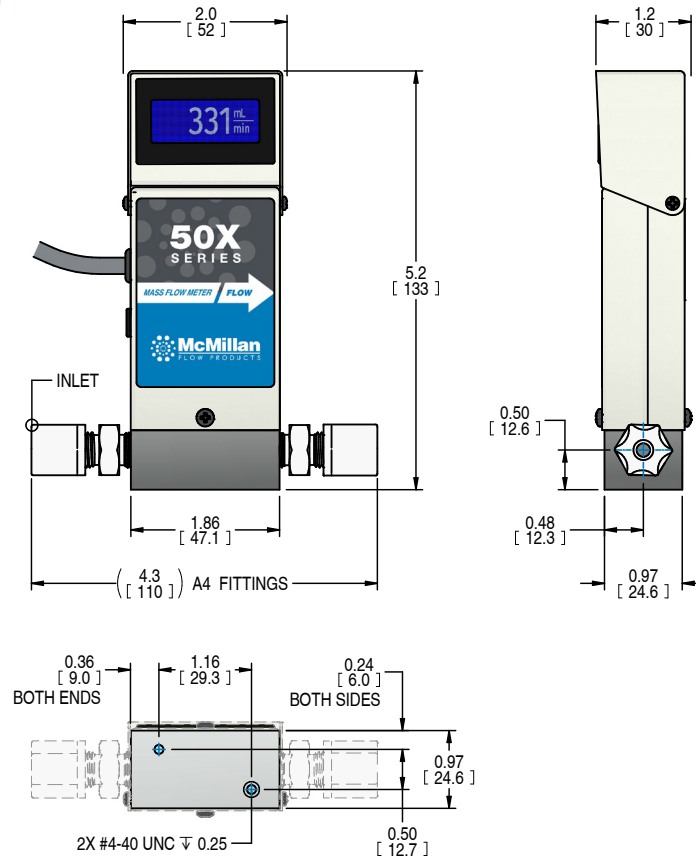
Dimensions

Basic unit configurations are shown. Contact factory or an authorized representative for dimensions of units not shown.
All dimensions shown in inches [mm] unless otherwise noted.

MODELS 50K | 50S

1.9 [49]
1.2 [30]
3.8 [97]
INLET
0.50 [12.6]
0.48 [12.3]
0.97 [24.6]
1.86 [47.1]
(4.3 [109]) A4 FITTINGS

0.35 [8.9] BOTH ENDS
1.16 [29.3]
0.24 [6.0] BOTH SIDES
0.97 [24.6]
2X #4-40 UNC ▼ 0.25
0.50 [12.7]

MODELS 50D | 50SD

2.0 [52]
1.2 [30]
331 mL/min
5.2 [133]
INLET
0.50 [12.6]
0.48 [12.3]
0.97 [24.6]
1.86 [47.1]
(4.3 [110]) A4 FITTINGS

0.36 [9.0] BOTH ENDS
1.16 [29.3]
0.24 [6.0] BOTH SIDES
0.97 [24.6]
2X #4-40 UNC ▼ 0.25
0.50 [12.7]

# Options & Accessories

CODE	DESCRIPTION
50-C-X	6-pin mating cable with pigtail leads, 36" length [92 cm]
A-115VAC	115 VAC Power Package, 0-5 VDC Output, only use with D Power/Signal Option
A-230VAC	230 VAC Power Package, 0-5 VDC Output, only use with D Power/Signal Option
275A/275B	External panel mount digital flow rate display

Related Products

S Series Flow Meters
Flow meters with
integrated flow rate display
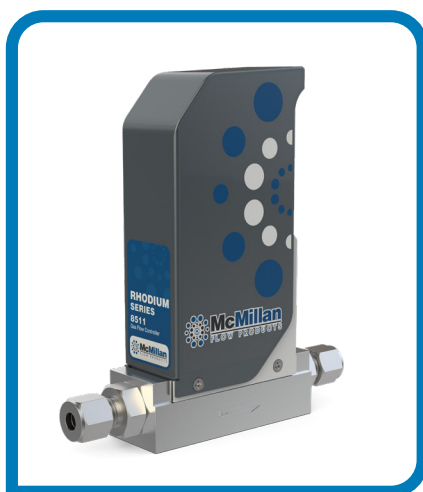
RHODIUM Series
Flow Controllers
MEMS-based flow controller
for gas applications

Model 100 Flow Sensors
Microturbine flow sensors
for gas applications

Specifications subject to change without notice.

Document DS-50X 2405 A